The New York State June 2008 Regents Physics Examination

An Analysis…

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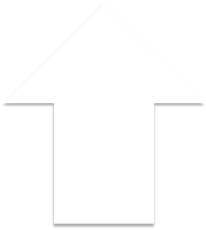


Easier Multiple Choice Items

Base your answers to questions 50 and 51 on the table below, which shows data about various subatomic particles.

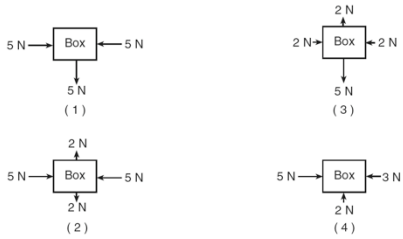
Subatomic Particle Table

Symbol	Name	Quark Content	Electric Charge	Mass (GeV/c^2)
p	proton	uud	+1	0.938
$\bar{p}$	antiproton	$\bar{u}\bar{u}\bar{d}$	−1	0.938
n	neutron	udd	0	0.940
λ	lambda	uds	0	1.116
Ω^-	omega	sss	−1	1.672

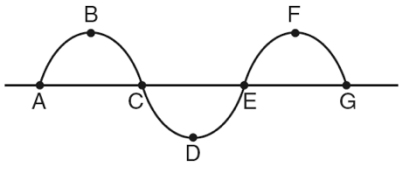
50 Which particle listed on the table has the opposite charge of, and is more massive than, a proton?

(1) antiproton
(2) neutron
(3) lambda
(4) omega

9 Which diagram represents a box in equilibrium?



27 The diagram below represents a transverse wave.



The wavelength of the wave is equal to the distance between points

(1) *A* and *G*
(2) *B* and *F*
(3) *C* and *E*
(4) *D* and *F*

29 The speed of light in a piece of plastic is 2.00×10^8 meters per second. What is the absolute index of refraction of this plastic?

(1) 1.00
(2) 0.670
(3) 1.33
(4) 1.50

2 A projectile launched at an angle of 45° above the horizontal travels through the air. Compared to the projectile's theoretical path with no air friction, the actual trajectory of the projectile with air friction is

(1) lower and shorter
(2) lower and longer
(3) higher and shorter
(4) higher and longer

14 A 0.45-kilogram football traveling at a speed of 22 meters per second is caught by an 84-kilogram stationary receiver. If the football comes to rest in the receiver's arms, the magnitude of the impulse imparted to the receiver by the ball is

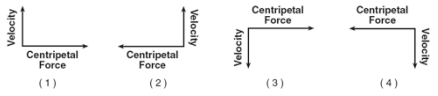
(1) 1800 N•s
(2) 9.9 N•s
(3) 4.4 N•s
(4) 3.8 N•s

13 A 1750-kilogram car travels at a constant speed of 15.0 meters per second around a horizontal, circular track with a radius of 45.0 meters. The magnitude of the centripetal force acting on the car is

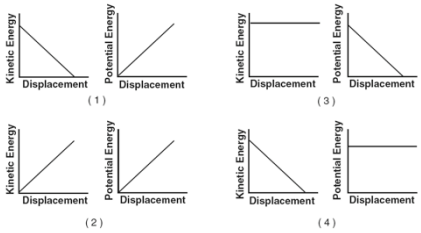
(1) 5.00 N
(2) 583 N
(3) 8750 N
(4) 3.94×10^5 N

10 The diagram below shows an object moving counterclockwise around a horizontal, circular track.

Which diagram represents the direction of both the object's velocity and the centripetal force acting on the object when it is in the position shown?



45 An object is thrown vertically upward. Which pair of graphs best represents the object's kinetic energy and gravitational potential energy as functions of its displacement while it rises?

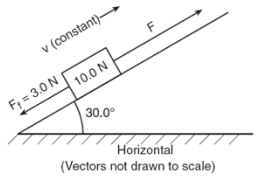


26 An electromagnetic AM-band radio wave could have a wavelength of

(1) 0.005 m
(2) 5 m
(3) 500 m
(4) 5 000 000 m

More Difficult Multiple Choice Items

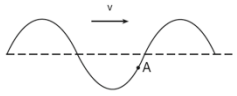
39 A block weighing 10.0 newtons is on a ramp inclined at 30.0° to the horizontal. A 3.0-newton force of friction, F_f, acts on the block as it is pulled up the ramp at constant velocity with force F, which is parallel to the ramp, as shown in the diagram below.



What is the magnitude of force F?

(1) 7.0 N
(2) 8.0 N
(3) 10. N
(4) 13 N

48 The diagram below represents a transverse wave traveling to the right through a medium. Point A represents a particle of the medium.



In which direction will particle A move in the next instant of time?

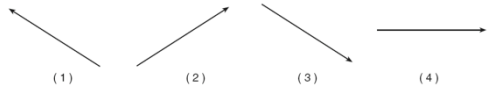
(1) up
(2) down
(3) left
(4) right

35 The total conversion of 1.00 kilogram of the Sun's mass into energy yields

(1) 9.31×10^2 MeV
(2) 8.38×10^{19} MeV
(3) 3.00×10^8 J
(4) 9.00×10^{16} J

41 The diagram below represents two concurrent forces.

Which vector represents the force that will produce equilibrium with these two forces?



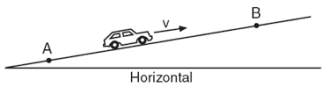
24 A circuit consists of a resistor and a battery. Increasing the voltage of the battery while keeping the temperature of the circuit constant would result in an increase in

(1) current, only
(2) resistance, only
(3) both current and resistance
(4) neither current nor resistance

44 Which combination of fundamental units can be used to express energy?

(1) kg•m/s
(2) kg•m²/s
(3) kg•m/s²
(4) kg•m²/s²

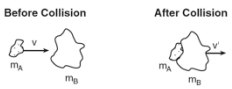
18 A car travels at constant speed v up a hill from point A to point B, as shown in the diagram below.



As the car travels from A to B, its gravitational potential energy

(1) increases and its kinetic energy decreases
(2) increases and its kinetic energy remains the same
(3) remains the same and its kinetic energy decreases
(4) remains the same and its kinetic energy remains the same

43 The diagram below represents two masses before and after they collide. Before the collision, mass m_A is moving to the right with speed v, and mass m_B is at rest. Upon collision, the two masses stick together.



Which expression represents the speed, v', of the masses after the collision? [Assume no outside forces are acting on m_A or m_B.]

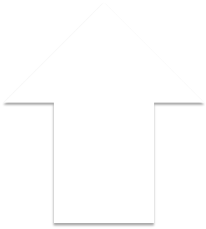
(1) $\frac{m_A + m_B v}{m_A}$
(2) $\frac{m_A + m_B}{m_A v}$
(3) $\frac{m_B v}{m_A + m_B}$
(4) $\frac{m_A v}{m_A + m_B}$

33 A mercury atom in the ground state absorbs 20.00 electronvolts of energy and is ionized by losing an electron. How much kinetic energy does this electron have after the ionization?

(1) 6.40 eV
(2) 9.62 eV
(3) 10.38 eV
(4) 13.60 eV

12 An 80-kilogram skier slides on waxed skis along a horizontal surface of snow at constant velocity while pushing with his poles. What is the horizontal component of the force pushing him forward?

(1) 0.05 N
(2) 0.4 N
(3) 40 N
(4) 4 N



Easier Constructed Response Items

Base your answers to questions 68 through 71 on the information and data table below.

The spring in a dart launcher has a spring constant of 140 newtons per meter. The launcher has six power settings, 0 through 5, with each successive setting having a spring compression 0.020 meter beyond the previous setting. During testing, the launcher is aligned to the vertical, the spring is compressed, and a dart is fired upward. The maximum vertical displacement of the dart in each test trial is measured. The results of the testing are shown in the table below.

Data Table

Power Setting	Spring Compression (m)	Dart's Maximum Vertical Displacement (m)
0	0.000	0.00
1	0.020	0.29
2	0.040	1.14
3	0.060	2.57
4	0.080	4.57
5	0.100	7.10

Directions (68–69): Using the information in the data table, construct a graph on the grid *in your answer booklet*, following the directions below.

68 Plot the data points for the dart's maximum vertical displacement versus spring compression. [1]

Directions (62–76): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 62 through 64 on the information below.

A kicked soccer ball has an initial velocity of 25 meters per second at an angle of 40.° above the horizontal, level ground. [Neglect friction.]

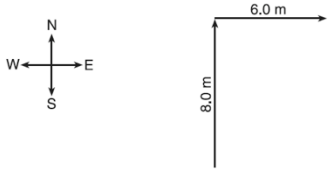
62 Calculate the magnitude of the vertical component of the ball's initial velocity. [Show all work, including the equation and substitution with units.] [2]

63 Calculate the maximum height the ball reaches above its initial position. [Show all work, including the equation and substitution with units.] [2]

64 On the diagram *in your answer booklet*, sketch the path of the ball's flight from its initial position at point *P* until it returns to level ground. [1]

Base your answers to questions 55 through 57 on the information and vector diagram below.

A dog walks 8.0 meters due north and then 6.0 meters due east.



55 Using a metric ruler and the vector diagram, determine the scale used in the diagram. [1]

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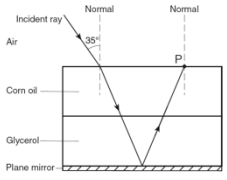
Directions (68–69): Using the information in the data table, construct a graph on the grid *in your answer booklet*, following the directions below.

68 Plot the data points for the dart's maximum vertical displacement versus spring compression. [1]

69 Draw the line or curve of best fit. [1]

Base your answers to questions 72 through 74 on the information and diagram below.

A ray of monochromatic light having a frequency of 5.09×10^{14} hertz is incident on an interface of air and corn oil at an angle of 35° as shown. The ray is transmitted through parallel layers of corn oil and glycerol and is then reflected from the surface of a plane mirror, located below and parallel to the glycerol layer. The ray then emerges from the corn oil back into the air at point *P*.



72 Calculate the angle of refraction of the light ray as it enters the corn oil from air. [Show all work, including the equation and the substitution with units.] [2]

73 Explain why the ray does *not* bend at the corn oil-glycerol interface. [1]

More Difficult Constructed Response Items

Base your answers to questions 75 and 76 on the information and data table below.

In the first nuclear reaction using a particle accelerator, accelerated protons bombarded lithium atoms, producing alpha particles and energy. The energy resulted from the conversion of mass into energy. The reaction can be written as shown below.

$$^{1}_{1}H + {}^{7}_{3}Li \rightarrow {}^{4}_{2}He + {}^{4}_{2}He + \text{energy}$$

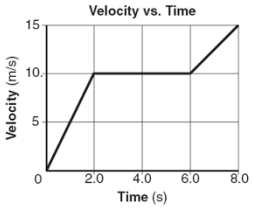
Data Table

Particle	Symbol	Mass (u)
proton	$^{1}_{1}H$	1.007 83
lithium atom	$^{7}_{3}Li$	7.016 00
alpha particle	$^{4}_{2}He$	4.002 60

75 Determine the difference between the total mass of a proton plus a lithium atom, $^{1}_{1}H + {}^{7}_{3}Li$, and the total mass of two alpha particles, $^{4}_{2}He + {}^{4}_{2}He$, in universal mass units. [1]

76 Determine the energy in megaelectronvolts produced in the reaction of a proton with a lithium atom. [1]

52 The graph below represents the velocity of an object traveling in a straight line as a function of time.



Determine the magnitude of the total displacement of the object at the end of the first 6.0 seconds. [1]

Part C

Answer all questions in this part.

Directions (62–76): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 62 through 64 on the information below.

A kicked soccer ball has an initial velocity of 25 meters per second at an angle of 40.° above the horizontal, level ground. [Neglect friction.]

62 Calculate the magnitude of the vertical component of the ball's initial velocity. [Show all work, including the equation and substitution with units.] [2]

63 Calculate the maximum height the ball reaches above its initial position. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 68 through 71 on the information and data table below.

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Directions (68–69): Using the information in the data table, construct a graph on the grid *in your answer booklet*, following the directions below.

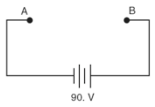
68 Plot the data points for the dart's maximum vertical displacement versus spring compression. [1]

69 Draw the line or curve of best fit. [1]

70 Using information from your graph, calculate the energy provided by the compressed spring that causes the dart to achieve a maximum vertical displacement of 3.50 meters. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 65 through 67 on the information and diagram below.

A 15-ohm resistor, R_1, and a 30.-ohm resistor, R_2, are to be connected in parallel between points *A* and *B* in a circuit containing a 90.-volt battery.



65 Complete the diagram *in your answer booklet* to show the two resistors connected in parallel between points *A* and *B*. [1]

In Conclusion…

- Some skill sets, such as inscription, remain more difficult for students.
- Mundane skill sets, such as plotting points and solving for commonly rehearsed variables, appear to be readily achieved.

For additional information:

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